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**HIRDLS observations of polar stratospheric clouds, cirrus near the tropopause, and background stratospheric aerosol**

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# Outline of Presentation



**Demonstrate that HIRDLS can detect**

- background stratospheric aerosol**
- polar stratospheric clouds (PSCs)**
- subvisible cirrus**

**Demonstrate that the**

- geophysical structure and**
- extinction values**

**of the HIRDLS observations are very reasonable**

**Discuss how this data can be used in  
science studies**

# HIRDLS Experiment



## 21 Spectra Channels

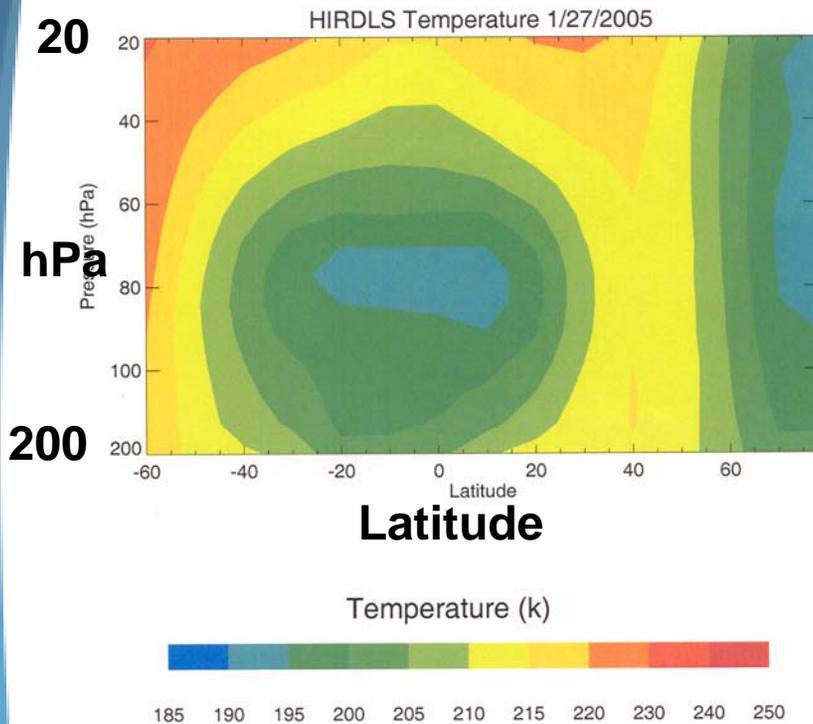
Radiometer, limb view

Several spectral channels are sensitive to aerosol and clouds

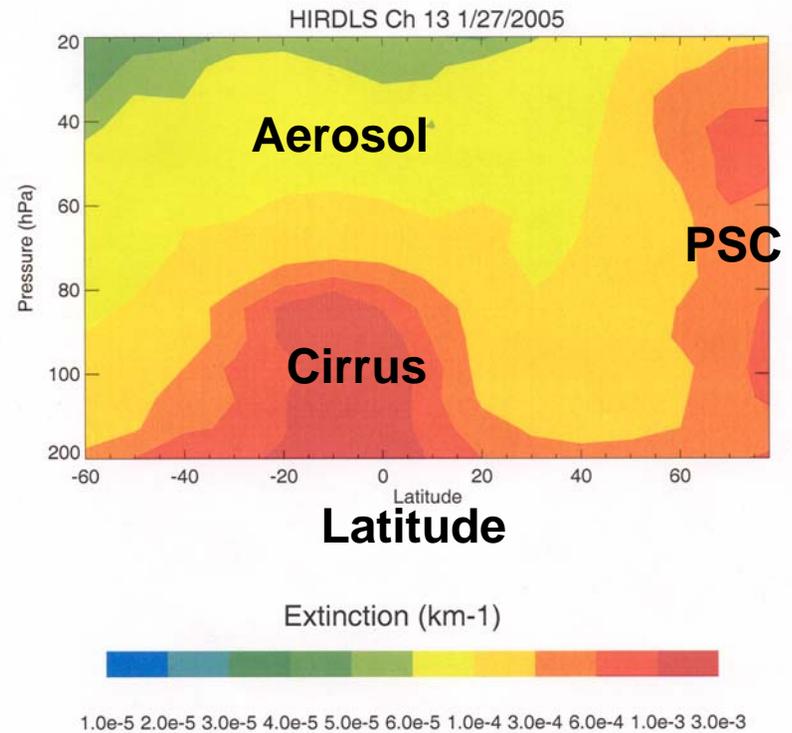
- gas contributions are minimal

<u>Channel</u>	<u>Wavelength</u>	<u>Comment</u>
1	17.3 $\mu\text{m}$	$\text{N}_2\text{O}$
6	12.0	"IR Window"
9	10.8	CFC12
13	8.1	near sulfate peak
19	7.1	$\text{H}_2\text{O}$ , $\text{O}_3$

# One Day's Retrieval 1/27/05

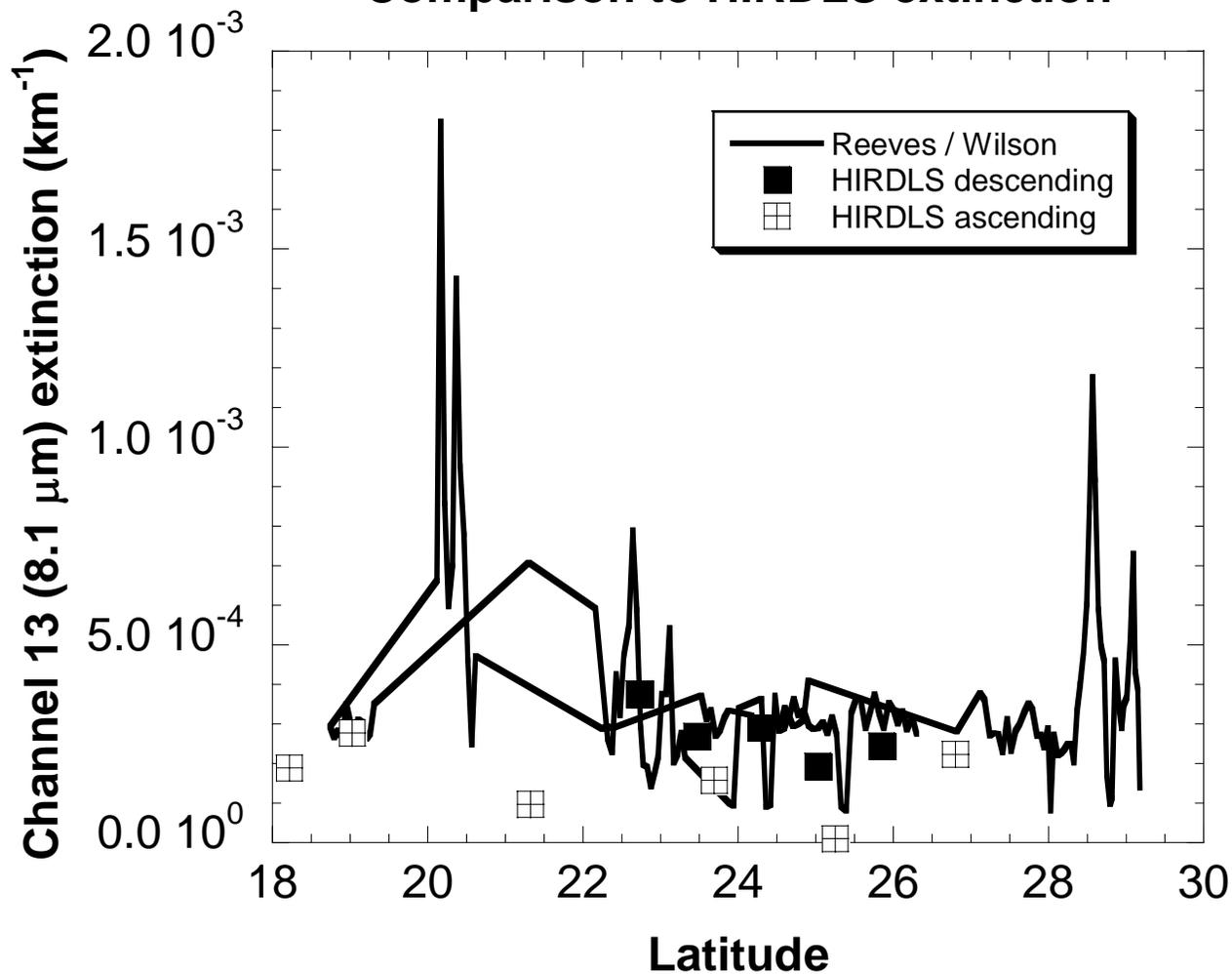


## HIRDLS Temperature



## HIRDLS Extinction

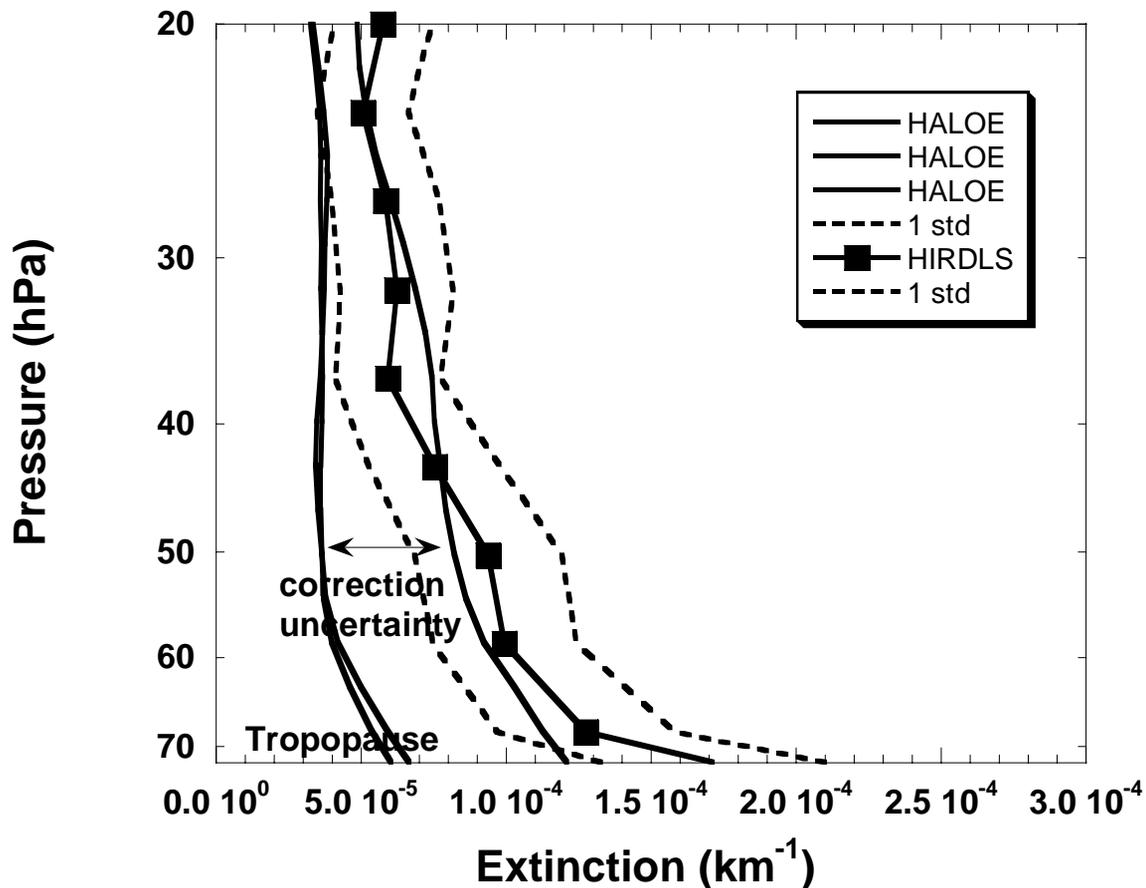
# June 19 WB-57 Flight Reeves / Wilson (DU) aerosol size distributions Comparison to HIRDLS extinction



**HIRDLS  
Channel 13  
data**

# HIRDLS – HALOE Comparison

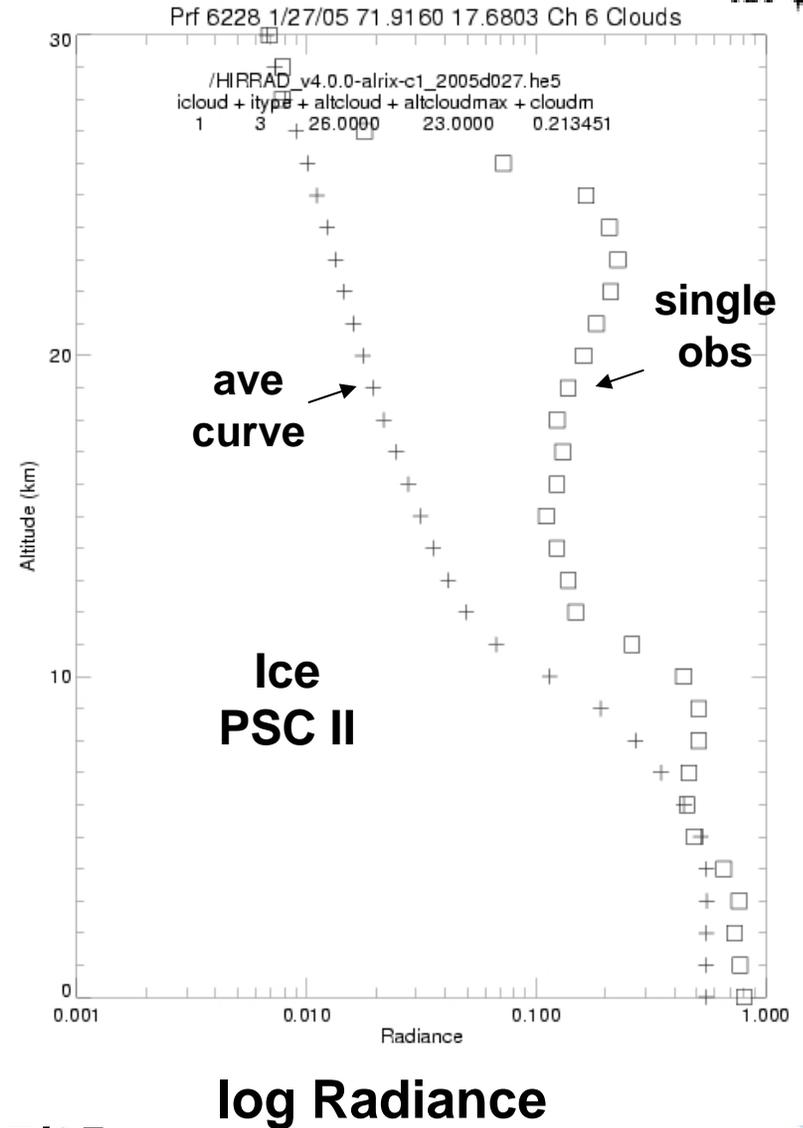
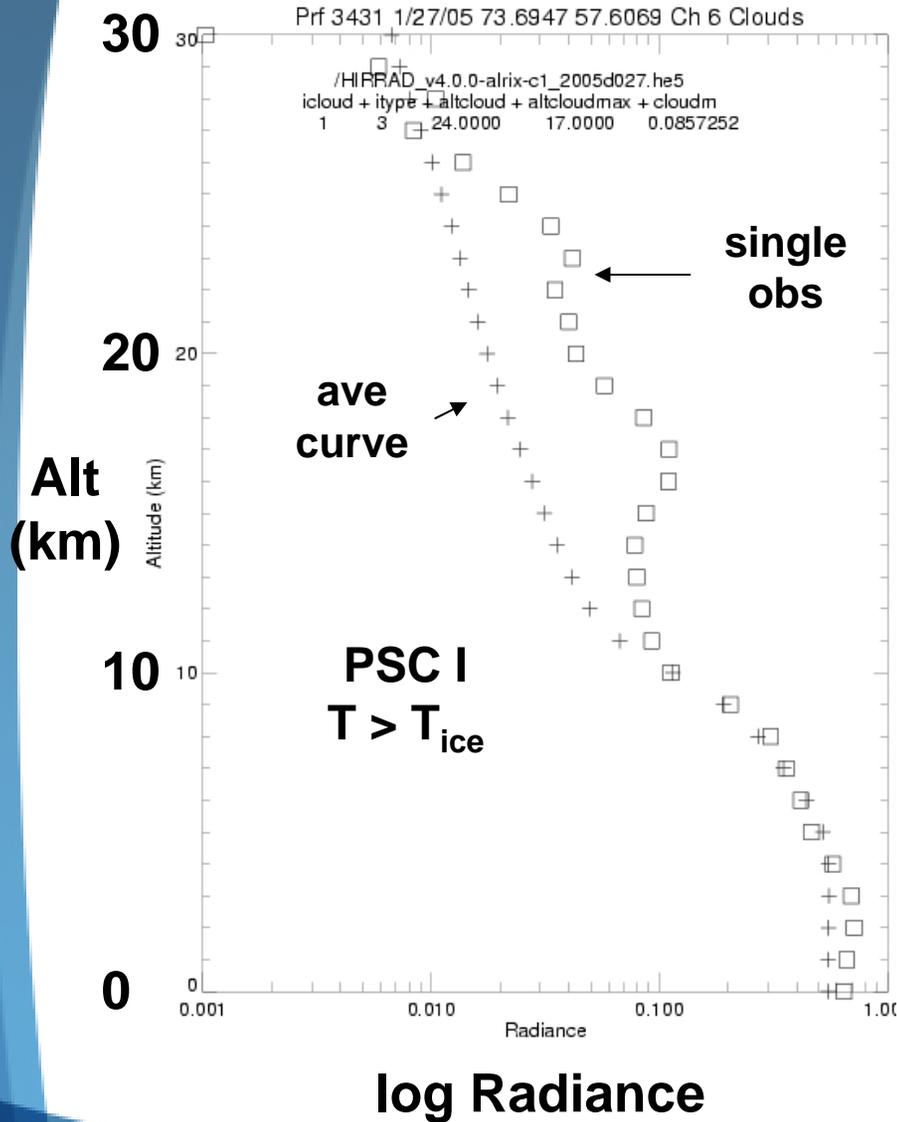
Comparison of HIRDLS and HALOE extinction  
HALOE data scaled to HIRDLS channel 13 wavelength  
January 27, 2005 10-15 N



# Examples of PSC radiance profiles



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1/27/05

# PSCs Observations on January 27

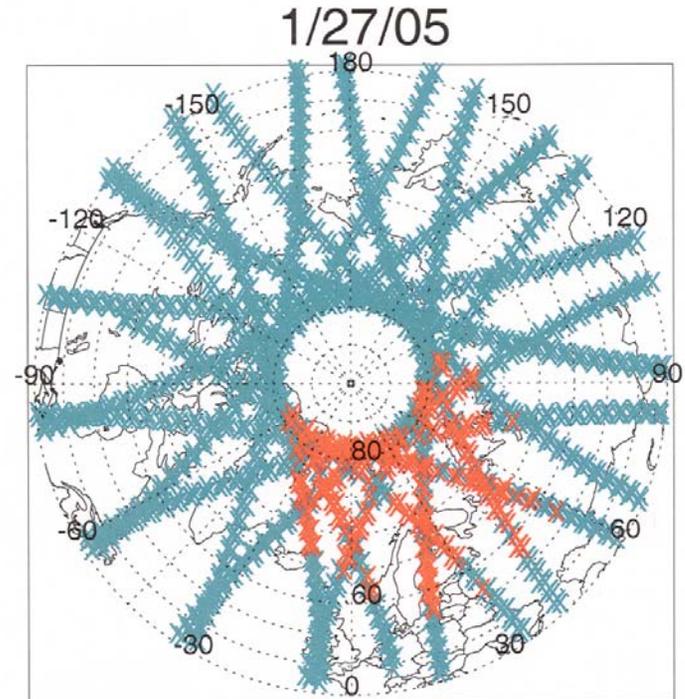
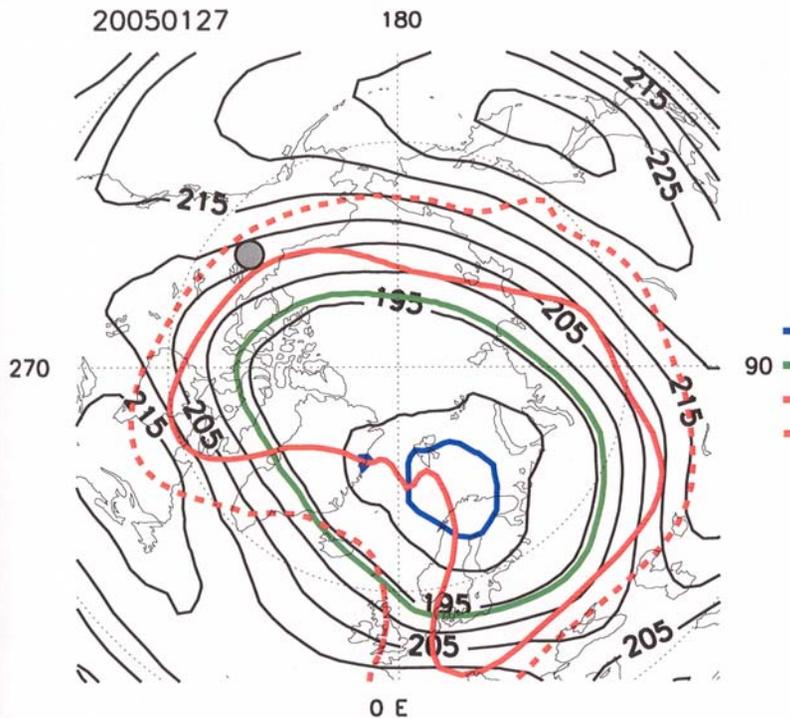


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## 450 K vortex geometry

## HIRDLS Observations

450 K UKMO Temperature (K), Nash Vortex, and POAM



**T < 195 K contour is given by the green line, Tice by the blue line, Nash vortex by the red line.**

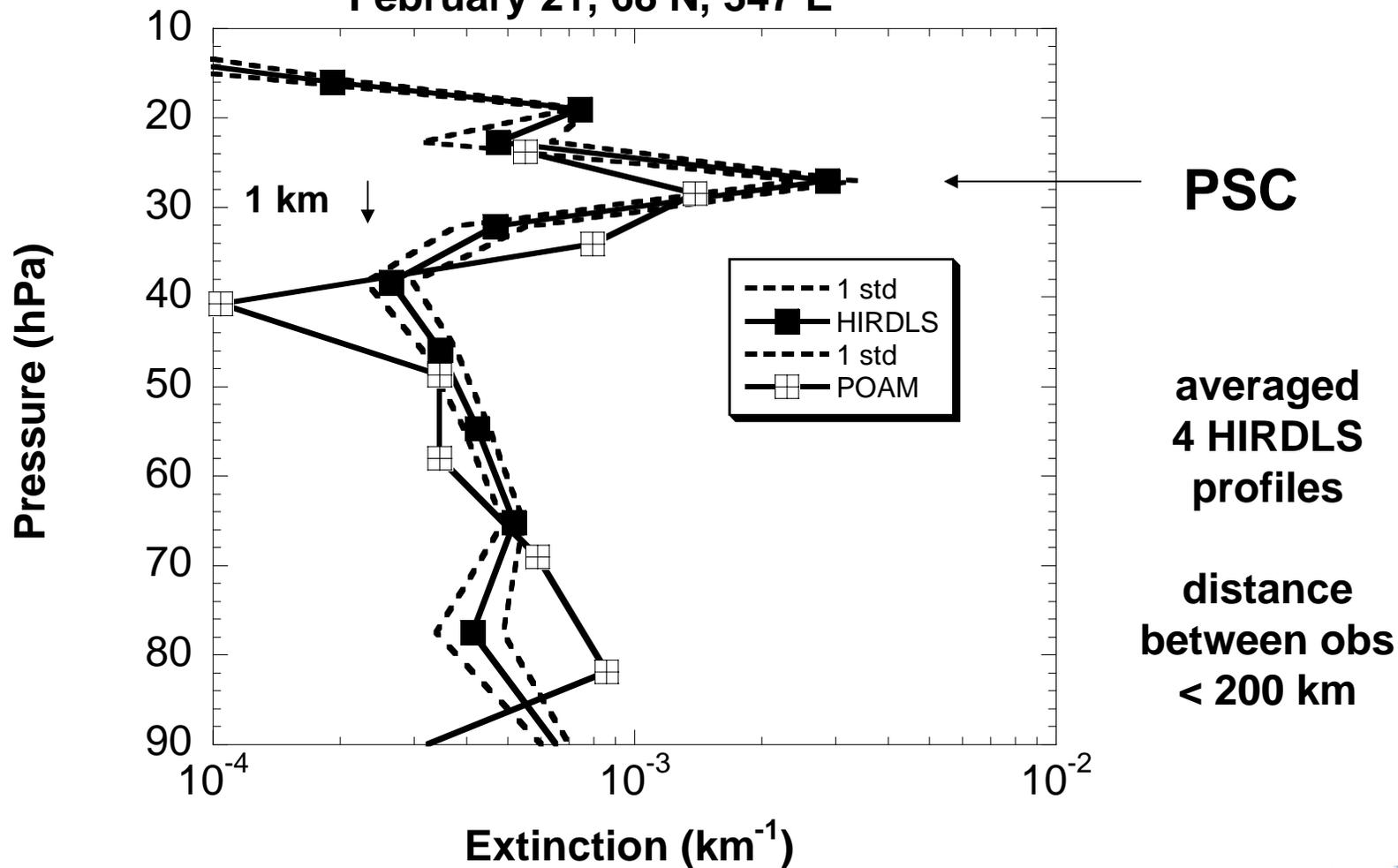
**PSCs are denoted by the red crosses, and blue crosses are non-PSCs**



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# HIRDLS and POAM Comparison

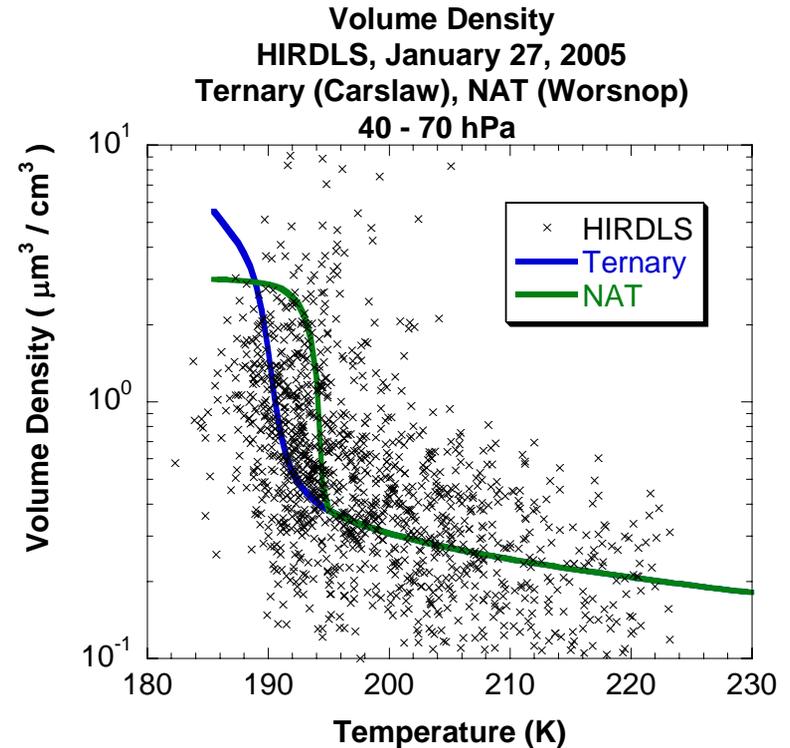
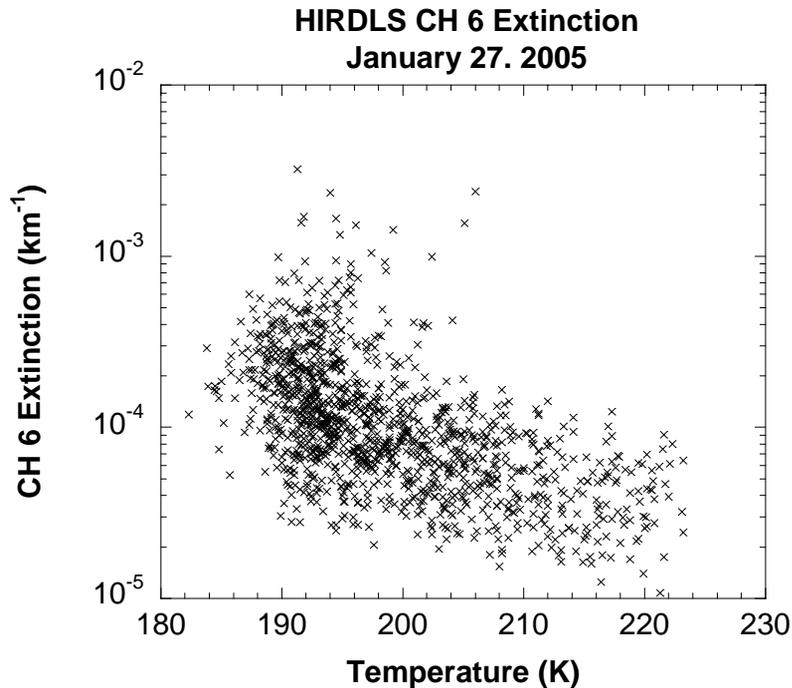
HIRDLS Channel 13 (8.1  $\mu\text{m}$ ), POAM 1.02  $\mu\text{m}$   
February 21, 68 N, 347 E



# PSC Observations



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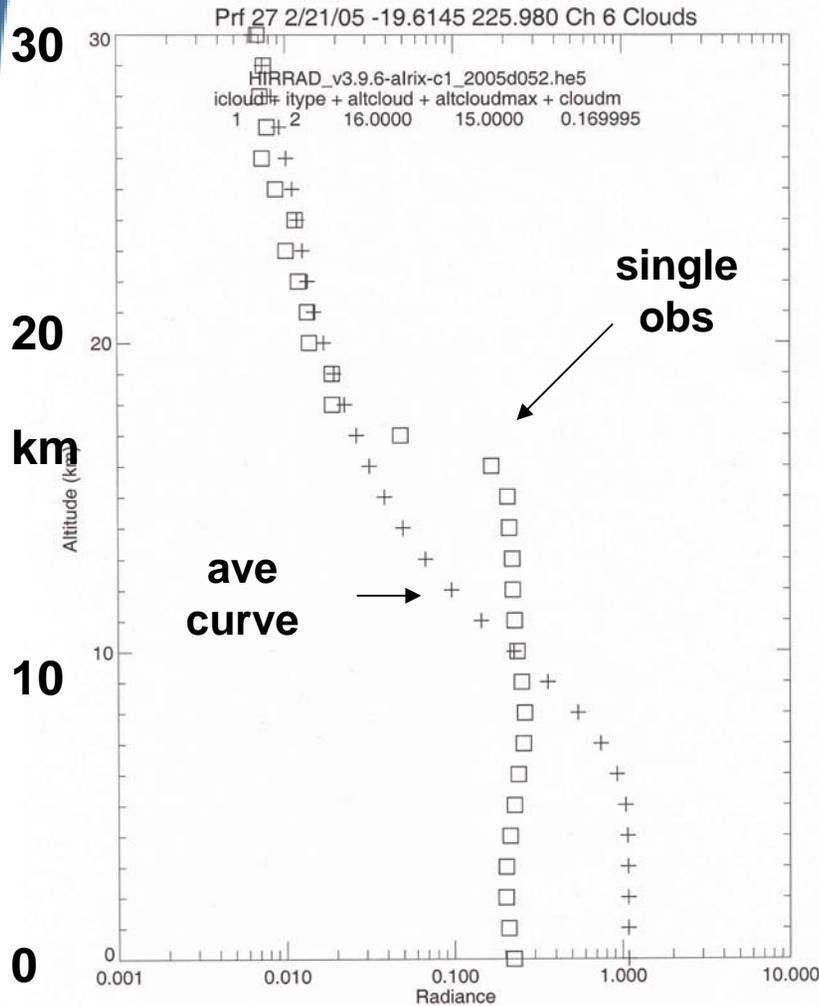
**Theory: Carslaw, Worsnop, Tabazadeh**

**Extinction -> Volume density, Massie et al. JGR, 103, p5773, 1998**

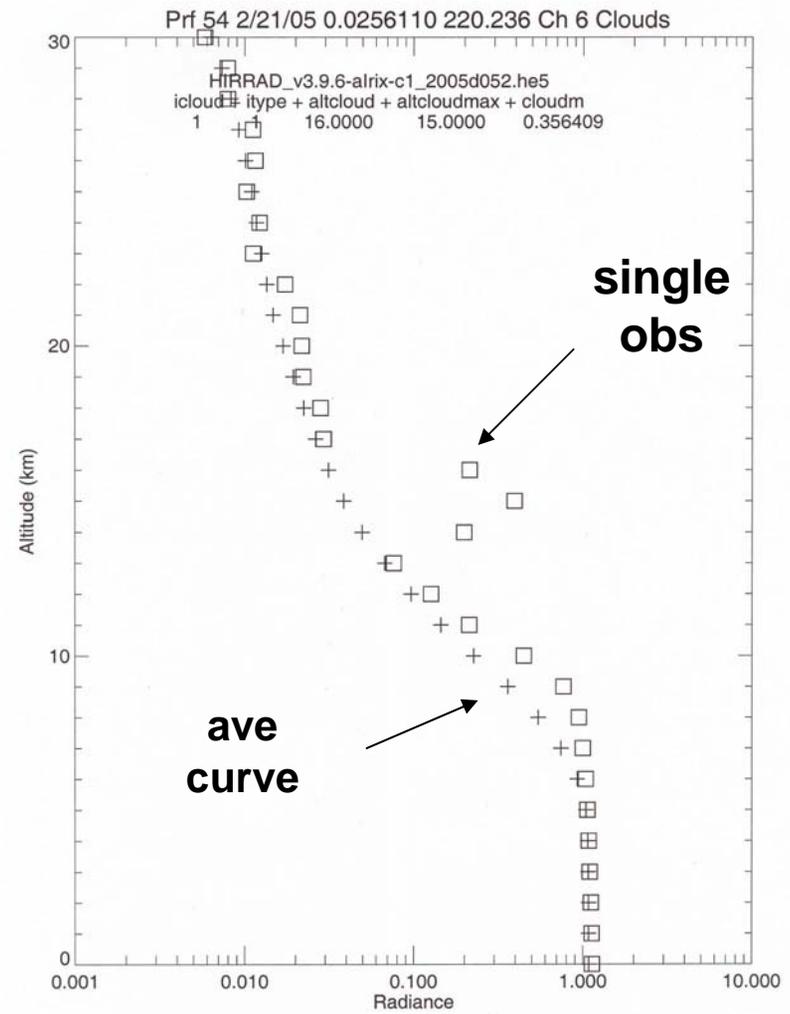
# Tropospheric Clouds Opaque and Subvisual Cirrus



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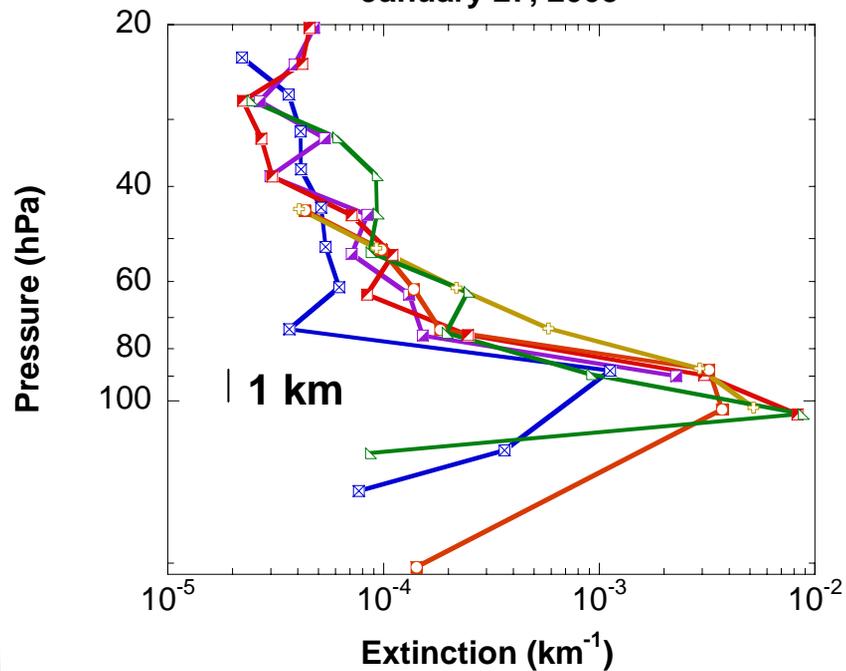
log rad  
**Opaque**



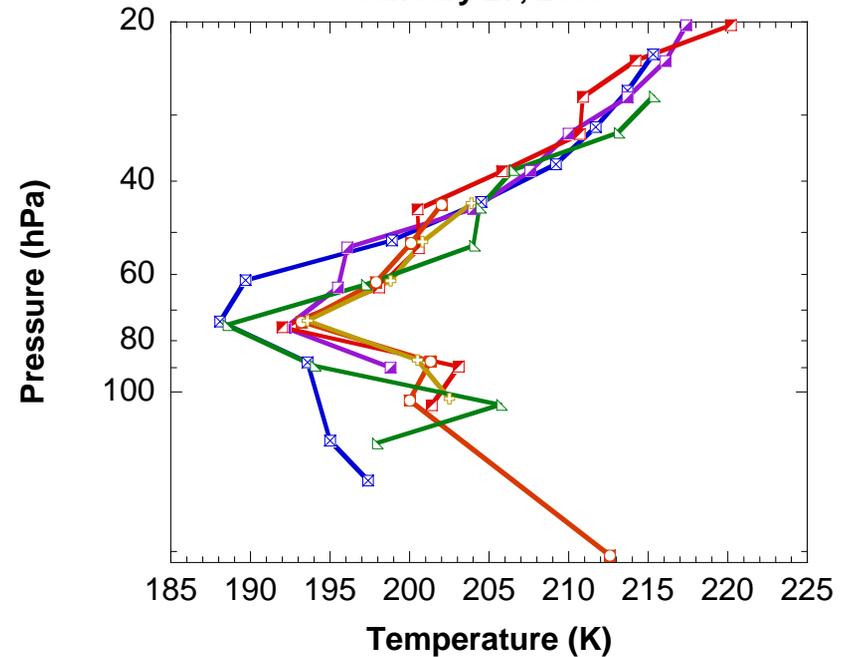
log rad  
**Cirrus Layer**

# Subvisual Cirrus Clouds Involved in UT/LS Dehydration Processes

Cirrus Laminar Layers  
Tropics  
January 27, 2005



Temperature Profiles  
Tropics  
January 27, 2005



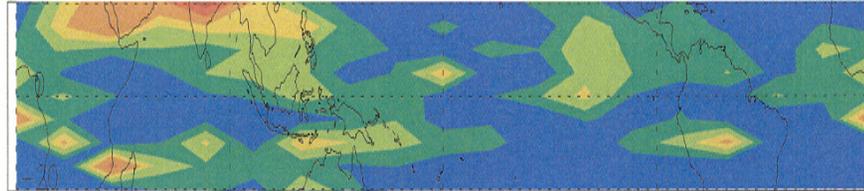
# Comparison to Climatology



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Cirrus 1995-2000 (exclude 1997) Summer

20 N

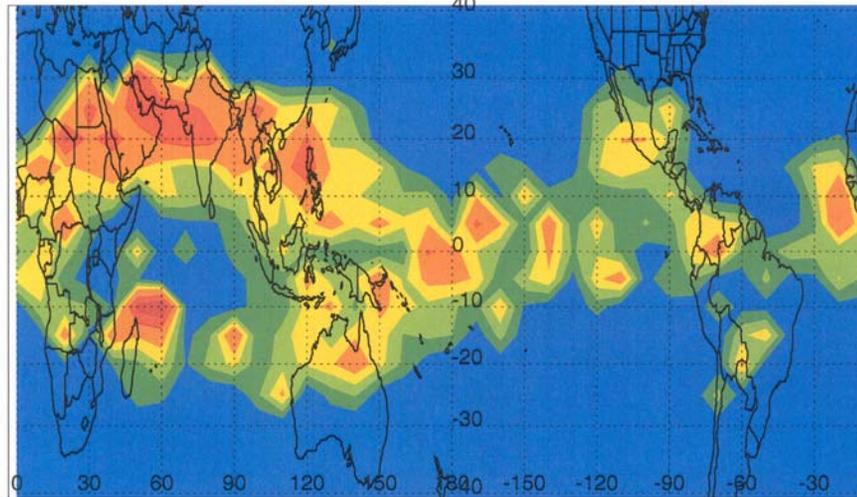


20 S

**HALOE**  
5 yrs data

Alt ~ 16 km, 2005 July - August

20 N



20 S

**HIRDLS**  
~ 100 hPa

Approx Ch 6 Layer Cirrus Extinction ( $0.001 \text{ km}^{-1}$ )



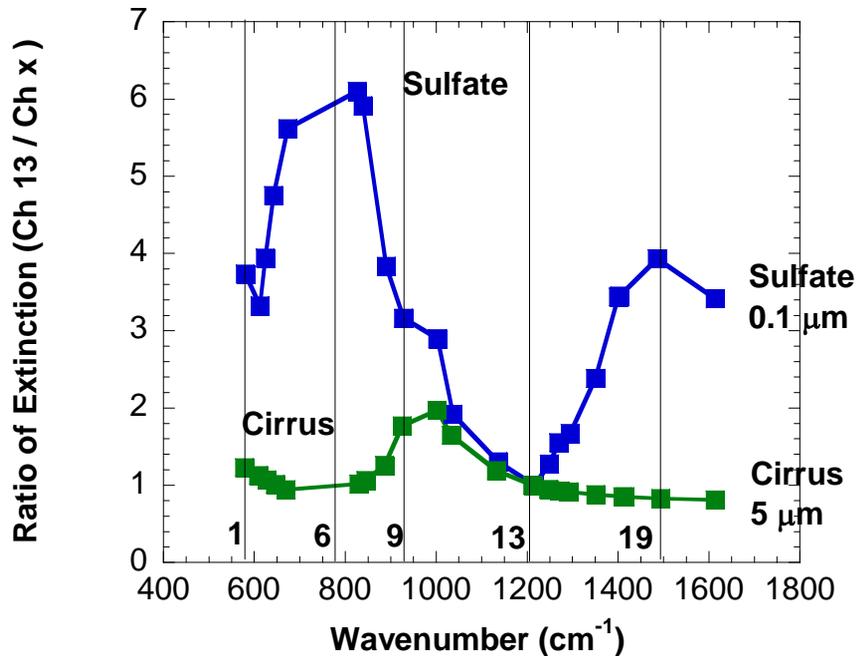
0.0 0.5 1.0 1.5 2.0 3.0 4.0 7.0 10

# Multi- Wavelength Extinction Ratios

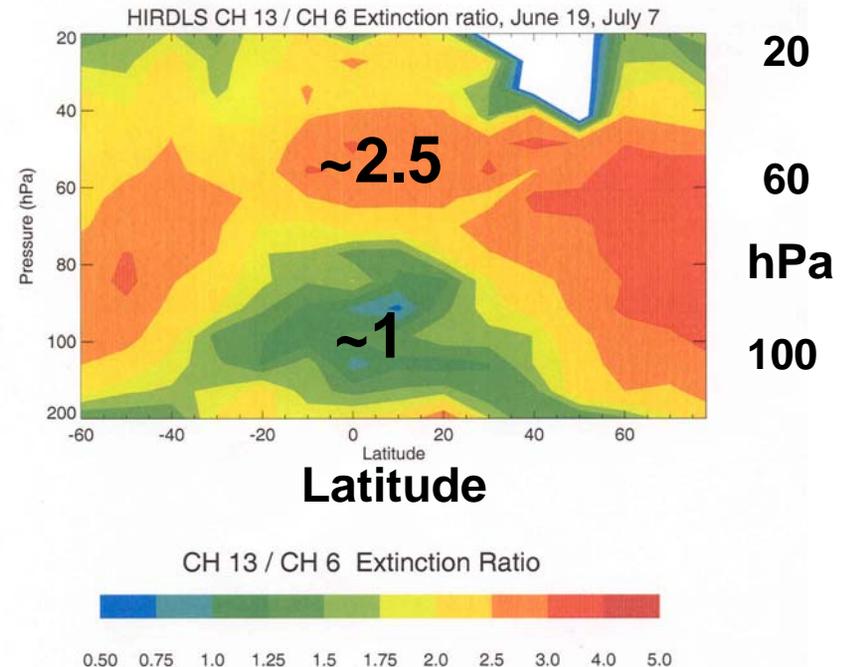


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## Theory - Mie



## HIRDLS Observations June 19, July 7

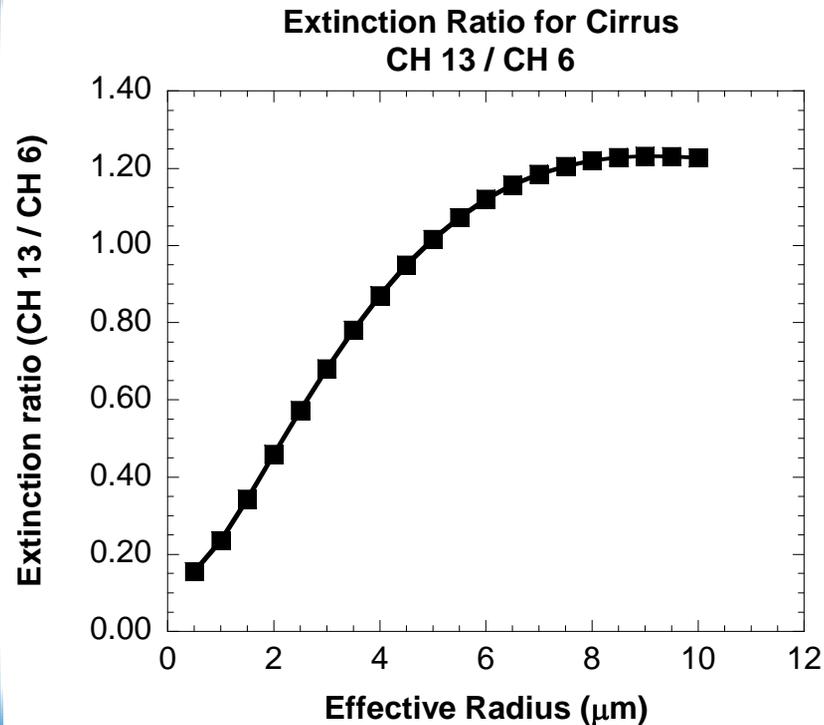


## Extinction Ratio, CH 13 / Ch 6

<u>Type</u>	<u>Theory</u>	<u>Obs</u>
Sulfate	6	2.5
Cirrus	1	1

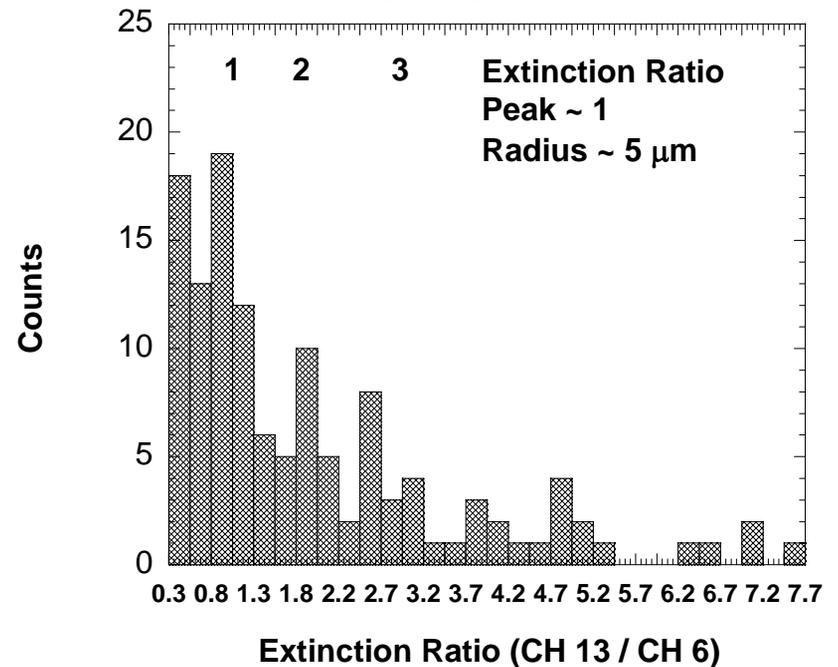
# Cirrus Radii - Reality Check

## Theory



## HIRDLS Observations

Observed Extinction Ratios  
Jan 27, June 19, July 7, 2005  
CH 13 / Ch 6



# Observational Goals



**Quantify the seasonal variations in the background stratospheric aerosol**

**Relate PSC temporal and spatial distributions to the production of active chlorine in the northern polar region**

**Relate subvisible cirrus to the seasonal variations of H<sub>2</sub>O near the tropopause (i.e. the H<sub>2</sub>O “tape recorder”)**